FOUNDATIONS

Spencer, White and Prentis Inc.

UNDERPINNING

SPENCER, WHITE AND PRENTIS, INC.

ENGINEERS AND CONTRACTORS

LAZARUS WHITE
PRESIDENT
CHARLES B. SPENCER
VICE PRESIDENT
EDMUND A. PRENTIS,
SEC'Y & CHIEF ENGINEER

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PILES
SHAFTS
TUNNELS
FOUNDATIONS
UNDERPINNING
STEEL AND CONCRETE CONSTRUCTION

A LETTER TO ARCHITECTS, ENGINEERS & CONTRACTORS CONCERNING FOUNDATIONS & UNDERPINNING

Gentlemen:

In presenting this catalog to you, we take great pride in quoting the late William A. Starrett, one of the world's great builders, in his introduction to "UNDERPINNING", by Prentis and White.

"Foundations have ever been the concern of mankind in the erection of its permanent structures. No structure has ever survived the destruction of its foundations unless they were replaced or strengthened. Such of them as have survived through the ages have done so primarily because of their foundations. It is interesting to reflect that this all-important subject received little attention as a science until the beginning of the present generation; men still living and active in engineering may be counted among the pioneers . . .

"Perhaps no group has done more to bring this refractory and baffling subject under scientific discipline than Charles B. Spencer, Edmund A. Prentis and Lazarus White. Skillful engineers that they are, they have put their knowledge to the most practical of tests by actually undertaking the projects then desired and contracting for their successful completion.

"Spencer, White and Prentis is a firm name that must be included in any category of the leaders in scientific design and construction of difficult foundations of our time. Their sound engineering knowledge is coupled with a practical ingenuity that commands the admiration of engineers everywhere."

If your problem is as special as reinforcing an existing foundation or as general as a subway, irrespective of the amount involved, you have the experience of a thousand installations at your service.

Yours very truly
SPENCER, WHITE & PRENTIS, INC.

By: Charles B Spencer
Vice-President

Note: You will Find the Following S. W. & P. Products in this Catalog as Shown Below.

SECTION OF THE NEW YORK CITY BUILDING CODE—*Covering Requirements for Concrete Filled Steel Piles* **WILL BE FOUND ON PAGE 11**

Tuba STEEL CYLINDER FOUNDATIONS

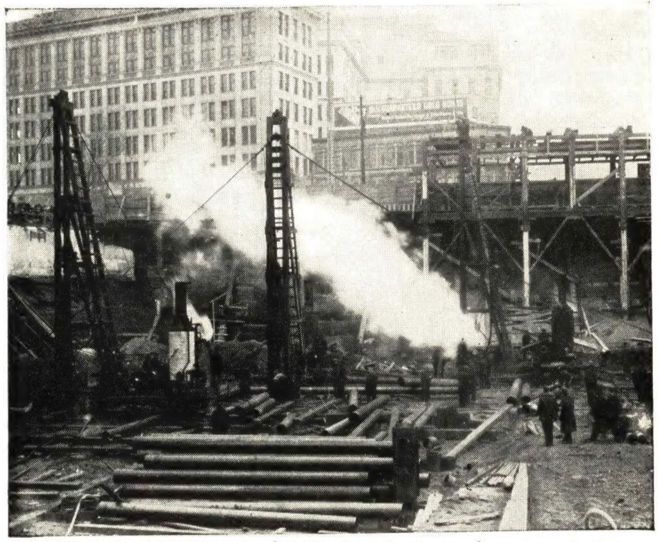
CONCRETE FILLED STEEL TUBES

Driven to Rock

TUBA STEEL CYLINDER FOUNDATIONS are composed of groups of concrete filled steel cylinders. Each cylinder consists of sections of lap-welded or seamless steel tubing driven to rock, excavated, filled with concrete, and cut off at the required elevation.

The tubing is driven through the overlying material to rock by means of steam or pneumatic hammers. Standard lengths of tubing are approximately twenty feet, and where the depth of rock necessitates the use of more than one length, the sections are joined together by tight fitting internal sleeve couplings.

A group of cylinders is installed for the support of each column or concentration of loading; or they may be uniformly spaced under a bearing wall.



INSTALLING Tuba Steel Cylinders for large department store at Newark, New Jersey

SAFETY, SPEED & ECONOMY

SAFETY.

TUBA STEEL CYLINDERS are concrete steel columns bearing on rock. The carrying capacity of the cylinders is derived almost entirely from end bearing, and not from "skin-friction". They are not therefore dependent upon the quality of overlying strata nor are they affected by future adjoining operations.

TUBA STEEL CYLINDER FOUNDATIONS are universally accepted as the equivalent in every respect of the usual open or pneumatic caissons.

Over a period of many years, many loading tests of TUBA STEEL CYLINDERS have been made. No appreciable settlements have ever been obtained, even though these tests were performed with loadings greatly in excess of those for which the cylinders are designed, and were invariably made on the empty shell before filling with concrete.

EXCAVATING Tuba Steel Cylinders by means of compressed air

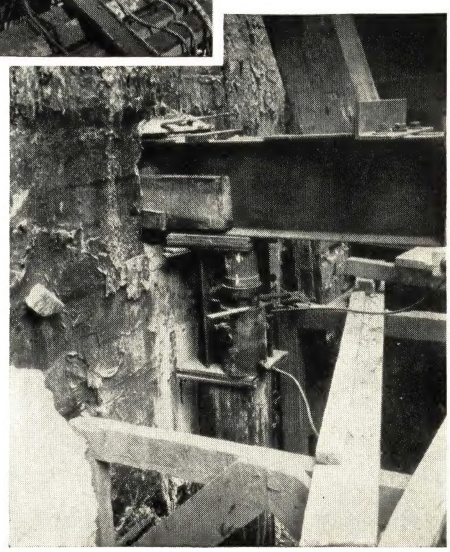
SPEED.

For depths of twenty to thirty feet, TUBA STEEL CYLINDERS afford a time saving over open caissons of approximately fifty per cent. For greater depths and adverse soil conditions the time saving is still greater.

ECONOMY.

Generally, TUBA STEEL CYLINDERS can be installed at much lower cost than piers to rock. For great depths and water conditions, the saving is considerable. As TUBA STEEL CYLINDERS can be driven close to adjacent structures, they eliminate the costly cantilever construction of exterior columns inherent to other types of foundations.

In the case of open piers, an extra depth of a few feet may as much as double the cost of the pier. The same extra depth in the case of a TUBA STEEL CYLINDER pier will increase the cost only in proportion to the depth, and in some cases even less. The use of TUBA STEEL CYLINDER FOUNDATIONS may, therefore, be regarded as insurance against greatly increased cost due to inaccurate or insufficient information as to the depth of rock.



TEST of Tuba Steel Cylinder using adjoining wall as reaction

TECHNICAL DATA, PERFORMANCE, INSTALLATIONS

DIAMETERS & THICKNESS OF TUBES. TUBA STEEL CYLINDERS are of steel tubing $10\frac{3}{4}''$ to $20''$ outside diameter, $\frac{5}{16}''$ to $\frac{5}{8}''$ thick.

METHOD OF DRIVING. Cylinders are driven in one of three ways. They may be placed upright in wood frames which serve as guides, and driven by hammers placed upon them by derricks or cranes. They may be driven in "leads", portable self-contained units comprising guides, hammer and hoisting engine. Or they may be driven in "swinging leads", in which the guides and hammer are suspended from the boom of a crane.

Hammers are actuated by steam or compressed air, and are of the single-acting or double-acting type. In the former the steam or air raises the striking part of the hammer and the latter falls through the action of gravity alone. In the double-acting hammer the steam or air raises the striking part and is introduced into the cylinder on the down stroke as well, supplementing the action of gravity.

METHOD OF CLEANING. The material through which the cylinder is driven remains within the tube, and is removed to permit of inspection of the rock, and the filling of the tube with concrete. The material may be removed by hand tools or by the use of water or compressed air jets. The latter method is the most common, and consists of introducing within the cylinder a smaller pipe through the lower end of which compressed air is expelled. The air expands and rises rapidly, carrying with it the material within the cylinder. The smaller, or "blow" pipe is usually $2\frac{1}{2}$ inches in diameter, and the air pressure employed varies between 85 and 100 pounds.

DESIGN. A group of TUBA STEEL CYLINDERS is placed for the support of each concentration of loading. The size and number of cylinders in a group depend upon the load to be supported.

Installing Tuba Steel Cylinders inside of building for support of new floor, American Brass Co., Hastings, N. Y.

Tuba Steel Cylinders being installed for Starrett Lehigh Building, N. Y. C. Cylinders driven to rock at depths as great as 155 ft. below grade

COMPUTATION OF LOADS. (See New York City Building Code, page 11.) TUBA STEEL CYLINDERS are figured as unsupported columns. For convenience the old New York City Building Code provided a unit load of 500 pounds per square inch on the concrete, and 7500 pounds per square inch on the steel shell, the outside $\frac{1}{16}''$ being discounted for corrosion. In the present Code, the values so obtained are slightly modified so as to give figures more convenient for use.

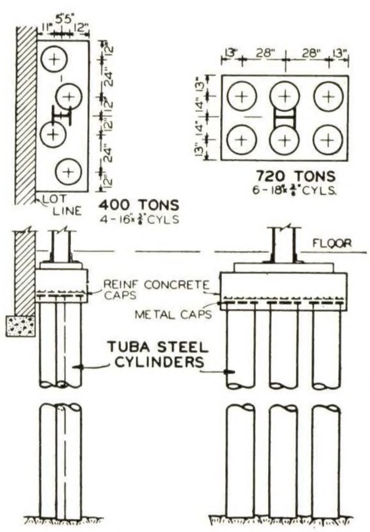
CORROSION. The deduction of the outside $\frac{1}{16}''$ as stated above is to provide for possible loss of metal through rust or deterioration. Steel cylinders in the ground will rust to some extent, but the amount is negligible. The first rusting, or oxidation, produces iron oxide which permeates the ground immediately surrounding the cylinder to a distance of several inches. Ground so permeated, however, is impervious to water. Iron oxide, in fact, is the basis of a well known system of water-proofing, and is a base for paint used on metals to prevent corrosion. The first rusting creates a protective coating which prevents further deterioration of the metal. This has been proven by exposing cylinders which have been in the ground for over twenty-five years, carefully cleaning and calipering them. In no case has any cylinder shown a loss of more than $\frac{1}{64}''$ of metal.

EFFECT OF TUBA STEEL CYLINDERS ON ADJOINING BUILDINGS. Due to uniform section, smooth surface, and the fact that no material is displaced, vibration is reduced to an absolute minimum. The underpinning and shoring of adjoining buildings necessitated by the use of open piers for exterior columns may be entirely eliminated by the use of TUBA STEEL CYLINDERS. The vibration caused by the driving of such cylinders is less than that resulting from the driving of sheeting for open piers, and far less than for any other type of pile.

FLEXIBILITY. There is no limit to the length of TUBA STEEL CYLINDERS, as is the case of concrete piles. They have been driven to depths as great as 155 feet. TUBA STEEL CYLINDERS can be installed inside of existing buildings, and in limited headroom conditions where other types of foundations cannot be used. For such installations shorter sections of tubing are used, and connected together by internal sleeve couplings. Numerous machinery foundations have been so installed, and under similar conditions TUBA STEEL CYLINDERS have been driven to depths as great as 90 feet for the support of floors in manufacturing buildings.

WHEN NOT DRIVEN TO ROCK. Desirable as it is to carry foundations to rock, it is often the case that the depth to rock is so great as to render rock bearing piles impracticable. In such cases, piles similar to the above may be driven into a stratum of sand, gravel or other firm bearing material. Such piles are driven with their ends closed by means of cast steel or cast iron points. The shell is filled with concrete and the resulting pile, though ordinarily figured at the usual concrete pile load of 30 tons, has many advantages over ordinary concrete piles. Their carrying capacity is derived almost entirely from end-bearing so that they are not affected by movements in the upper strata, nor by adjoining operations in the future. The use of the heavy steel shells which are left in place permits penetration through heavy obstructions and provides a factor of safety not present in other types of piling.

STRUCTURES SUPPORTED ON TUBA STEEL CYLINDERS. More than five hundred structures throughout this country, from two to forty-five stories in height, are supported on TUBA STEEL CYLINDERS. Some of these are listed on Page 10.



Typical Designs
Tuba Steel Cylinder Foundations

Pretest UNDERPINNING

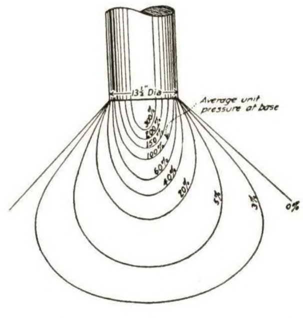
PRETEST UNDERPINNING is the highest development of the underpinning art, and is based upon recently established principles of Soil Mechanics. As it alone employes these principles, it is the system of underpinning which reduces settlement to an absolute minimum.

PRETEST UNDERPINNING is employed to provide new and deeper foundations for existing structures; to arrest the settlement of structures whose foundations have proven inadequate; and to increase the capacity of existing foundations to which loads are to be added. PRETEST UNDERPINNING is applicable to every type of structure and to nearly every ground condition. It entails the least interference with full use of the structure, and the least obstruction to adjoining property and streets during installation.

PRINCIPLES underlying the PRETEST METHOD. When jacked down under a test load, an underpinning cylinder (or other footing) builds up beneath it a resistance which prevents further penetration. Investigations have shown that this resistance is created by the interlocking and compacting of the grains of the bearing material. This distribution of pressure takes the form of the so-called "Bulb of Pressure".

As long as the load is maintained on the cylinder, the "Bulb of Pressure" is maintained. If the load is released, however, the "bulb" is partly, if not wholly destroyed. If the load is reapplied, and the cylinder again forced down, an equivalent "bulb" or resistance will again be created, but at some depth below that at which the original bulb occurred. That is, the cylinder must be forced to some greater depth in order to re-compact the material sufficiently to obtain the original carrying capacity. Results of repeated tests confirm that rebound follows each release of load, and that equal resistance under reloading is found only at greater depth.

If the jacks are removed after the cylinder has been tested to the required loading, rebound will occur. It is not possible through the medium of a wedging beam and steel wedges to re-apply to the cylinder the test load. This can only be obtained when the cylinder has penetrated to some depth greater than that at which it was originally tested. As such penetration is caused by the load of the structure being applied to the cylinder by the wedging beam, it must be accompanied by a settlement of the structure equal in amount to that of the additional penetration required.

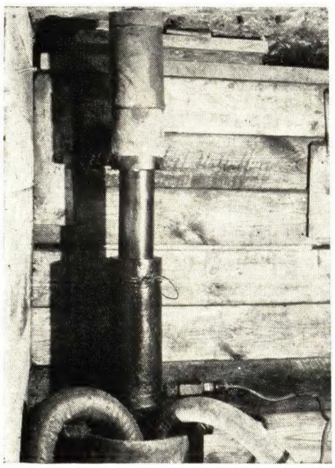


Distribution of pressures through soil beneath a footing as determined experimentally — known the "Bulb of Pressure."

THE PRETEST METHOD. Sectional steel cylinders are jacked down beneath the foundations of a structure to a satisfactory bearing material, after which they are cleaned out, and filled with concrete. Each cylinder is then tested to an overload capacity, usually 50% in excess of the permanent load. While the full test pressure is maintained on the jacks, a short steel column is placed on top of the cylinder, and the load of the footing is permanently transferred to the underpinning cylinder by means of steel wedges. The cylinder is prevented from rebounding and destroying the "bulb-of-pressure" which has been created beneath it.

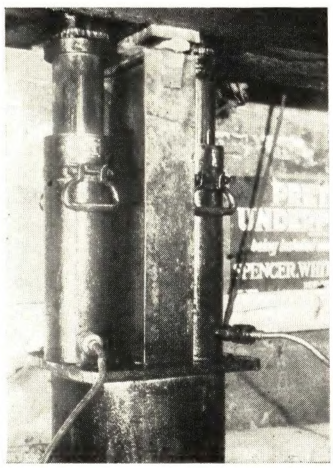
The essential difference between PRETEST UNDERPINNING and other methods is that in PRETEST UNDERPINNING the transfer of the load from the foundation to the underpinning cylinder is done with the full test load maintained on the cylinder by the jacks. There is no release of load while the wedging is being done. This method of transferring the load is the PRETEST feature which eliminates the damaging settlement inherent to other methods.

GROUP TESTING (Patented). When Pretest Cylinders are, of necessity, installed so close together that their "Bulbs-of-Pressure" overlap, it is customary to test and wedge them in groups in addition to testing them singly. This GROUP TESTING removes the possibility of overloading the cylinders and of releasing a portion of the load on any cylinder by subsequent installation of an adjacent one.

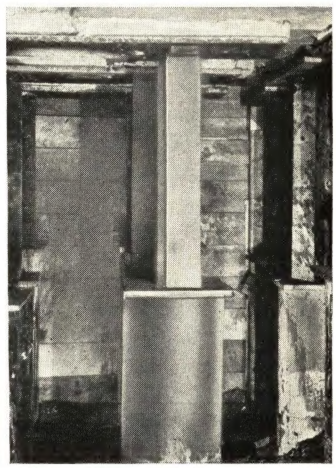


1 Jacking a sectional steel cylinder in a pit beneath a foundation. In this case a water jet and a pump suction remove the material from within the cylinder.

2 Testing the bearing capacity of a cylinder after it has been jacked to firm bearing, excavated, and filled with concrete.



3 With the full test pressure maintained on the jacks, a steel "wedging-beam" is inserted, and steel wedges driven between the beam and the steel plate under the foundation.



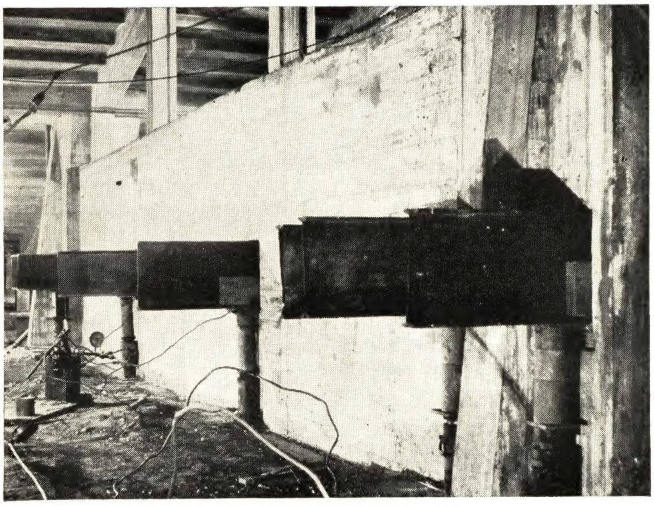
4 The jacks are removed, leaving a completed Pretest cylinder.

Pretest UNDERPINNING

PRETESTING SPREAD FOOTINGS. The PRETEST principle is also employed to increase the carrying capacity of spread footings. It is the most economical method of arresting the settlement of structures whose spread footings have proven inadequate, and of providing for increased loadings on footings which already carry full loads.

In order to PRETEST a spread footing, the wall or column which it supports is needled, and hydraulic jacks are set between the needles and the footing. If the footing supports a wall, the needles consist of beams placed through the wall; if the footing supports a steel column, the needles consist of structural steel brackets bolted or riveted to the column section.

With the wall or column above serving as a reaction, the footing is jacked down until there is obtained a resistance sufficient to support the permanent load. If the necessary reaction can be obtained without damage to the structure, it is customary to jack to a

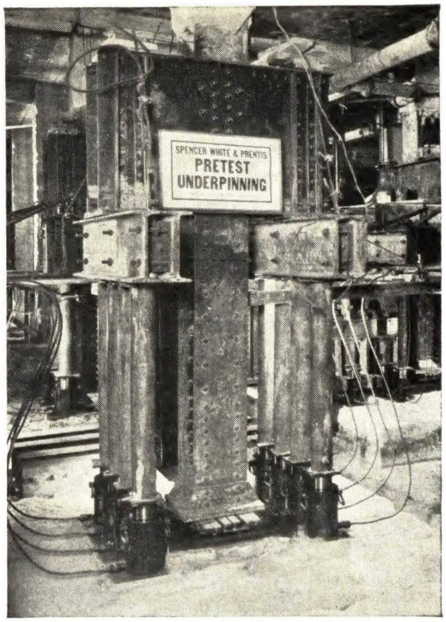


Pretesting spread footing beneath wall of Yankee Stadium, N. Y. C.

loading in excess of the permanent load. The jacking pressure is maintained for a sufficient time to insure against further depression of the footing. While the full test pressure is maintained on the jacks, steel wedges and shims are driven between the base of the wall or column, and the footing, by the PRETEST METHOD. It is essential that the wedging between the footing and the load it supports be done by the PRETEST METHOD. Only by this method is the "bulb-of-pressure" maintained, and the success of the operation assured.

When the footings occupy almost the entire area of the site, or are at water level, the conditions may be such that PRETESTING the spread footings themselves is not sufficient. In such cases it is possible to secure greater bearing capacity by a combination of PRETEST UNDERPINNING and PRETESTING of the footings. The practice then is to install permanent needles, riveted to steel columns or passed through walls; beneath these needles underpinning cylinders are placed in sufficient numbers to provide the additional carrying capacity, and tested and wedged by the PRETEST METHOD; the spread footings are then PRETESTED in the usual manner.

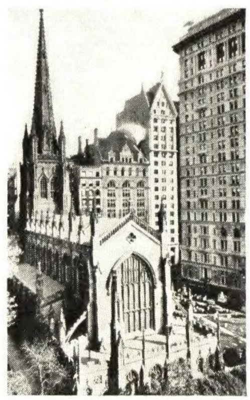
In some instances such as where boulder fill deposited in soft ground, or similar conditions make spread footings the only economical foundations, but with the probability of unequal settlements, the foundations are designed in advance for future PRETESTING. Brackets are provided on columns or niches are left in concrete walls for the installation of beams, so that they can be needled at minimum cost. Where settlement occurs, the footings are jacked down against the needles, and wedged by the PRETEST METHOD. This construction has proven to be very economical, and has saved considerable time in construction.



Pretesting a spread footing under a column loading of 400 tons.

U. S. Sub-Treasury Building, Wall St., N. Y. C.

National Bank of Commerce, N. Y. C.



Trinity Church, Broadway, N. Y. C.

INSTALLATIONS. PRETEST underpinning has been installed under hundreds of structures, including buildings up to 28 stories in height, bridge piers, retaining walls, chimneys, elevated railway columns, etc. Single column loads have run as high as 1300 tons. Bearing materials have included sand and clay mixtures, sand, gravel, hardpan and rock. In some cases cylinders have penetrated to depths as great as 90 feet. They have frequently penetrated through quicksand and other unstable materials, and in most cases through water bearing ground.

UNDERPINNING of STRUCTURES on WOOD PILES. Settlements of structures founded on wood piles are usually due to (1) Deterioration of the upper portions of the piles due to a recession of the permanent ground water level, (2) Reduction of the cross-sectional area of the piles due to the action of marine borers, (3) Failure to drive piles to a proper penetration when originally installed. For the first condition stated above

the pile is cut off at the permanent ground water level or a short distance below same, PRETESTED against the footing above, and the upper portion replaced by a steel I beam section. For the second condition the affected portion of the pile is removed, and the pile PRETESTED and finished as above. For the third condition, the top of the pile is removed for a length sufficient to permit the installation of the jacks, and the pile driven hydraulically by using the footing above as a reaction; when proper penetration has been obtained the top of the pile is replaced by a steel I beam section PRETESTED in place.

Installations of this type:

Jackson Laboratory, E. I. du Pont de Nemours & Co., Deep Water Point, N. J.

Beards Erie Basin, Brooklyn, N. Y.

The PRETEST principle, first developed for underpinning, has been adapted to the construction of new foundations. Where ground conditions are suitable, PRETEST FOUNDATIONS will result in a saving in both cost and time.

PRETEST FOUNDATIONS are installed by setting up short sections of cylinders in pits or trenches at the locations of the designed foundations. The cylinders are concreted and temporary short wood posts placed upon them. Concrete footings are then constructed, bearing on the blocking and on the earth at either side of the pits. The erection of the building is then begun.

When the erection of the building has proceeded to a height sufficient to provide a reaction equal to the designed load on a single cylinder, one of the cylinders in each group is jacked to firm bearing, tested, and permanently wedged against the footing.

As additional building load is applied Pretesting keeps pace with erection, until at completion the building is supported on a foundation, each unit of which has been tested to an overload capacity.

One of the distinct advantages of PRETEST FOUNDATIONS over foundations of other types is in the saving in time effected. The erection of the building itself begins practically at the same time as that of the foundations, thus saving the time usually spent in foundation work. Another advantage of this system is the fact that every unit of the foundation is actually tested for the load it is designed to support, a condition that obtains in no other type of foundation. Since the carrying capacity of each cylinder is demonstrated by actual test, the cylinders are forced down only to the depth required to secure the necessary support, instead of being driven to a predetermined depth which may be greater or less than that actually required.

PRETEST FOUNDATIONS are the only foundations in which every unit is completely tested before being used to support the structure. Spread footing and friction pile foundations are designed on the assumption that the material throughout the site is of uniform bearing value, and this bearing value is usually assumed arbitrarily. In PRETEST FOUNDATIONS whatever the assumption as to soil values, the cylinders will penetrate to whatever depth may be required to secure the test load.

PRETEST FOUNDATIONS have the full approval of the building departments of New York and other prominent cities, as well as that of leading engineers and architects.

Some notable PRETEST FOUNDATIONS:

Office Building (22 stories) 110 William St., New York City.

Hide & Leather Building (18 stories) Gold & Frankfort Sts., New York City.

N. Y. Edison Company Station, East 6th St., New York City.

American News Co. (12 stories) Varick St., New York City.

PRETEST SOIL EVALUATION. A PRETEST Soil Evaluation is the most accurate and economical means of determining the bearing value of a soil. A reaction is obtained, whenever possible, under an existing wall, or under beams placed between footings, walls or columns of an existing adjacent structure. When this cannot be done, reaction is obtained against the sides of a sheeted pit or trench, or a loaded platform. A steel plate of the required area placed beneath concrete or wood blocking is forced down by hydraulic jacks against this reaction.

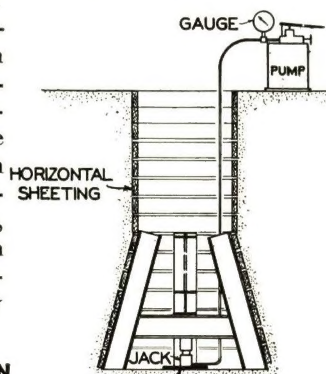
AT FARTHEST LEFT
Pretest Foundation, American News Building, N.Y.C.

AT LEFT
Installing Pretest Foundations.

By applying successively increasing loads and noting the settlement at each increment, a settlement curve can be plotted; this curve will indicate clearly the supporting power of the soil. By the use of a power pump and hydraulic accumulator an absolutely uniform pressure can be maintained for as long a period of time as desired. Tests have been run for several weeks with continuing settlement.

At any time a desired loading can be maintained for 24 or 48 hours or longer, by wedging between the test blocks and the reaction. Such wedging is performed by the PRETEST METHOD.

In a Pretest Soil Evaluation the loads are known exactly, successively increasing loads can be applied in a few minutes, the complete test performed in the presence of all interested parties in a short time, and any specified load can be left in place for any desired period of time at very low cost.



PRETEST SOIL EVALUATION
Test made at level of proposed new footings

CAISSON FOUNDATIONS

Spencer, White & Prentis and affiliated companies have installed many caisson foundations, including one of the deepest building foundations in the world, and are equipped to do both pneumatic and open caisson work.

These companies have developed improved methods for installing caisson foundations, resulting in reductions in both cost and time required for installation. Under many conditions these newer methods permit the use of open caissons in place of the more expensive pneumatic type.

Some of the caisson foundations installed are:
Central Savings Bank, New York City
21 West Street Building, New York City
American Radiator Co., New York City
Gordon Baking Co., Long Island City. N. Y.
Fidelity Phila. Trust Co., Phila., Pa.
Cleveland Union Terminal, Cleveland, Ohio
City Hall, Buffalo, N. Y.

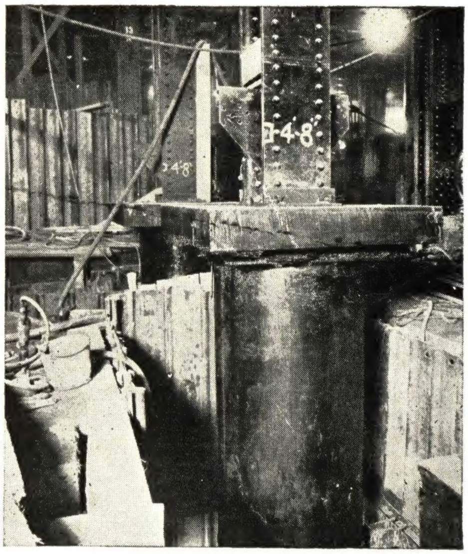
FOUNDATIONS UNDER EXISTING BUILDINGS. To save time in construction, Spencer, White & Prentis have developed methods for installing new building foundations prior to or during the demolition of existing buildings on the site. Time so saved has run from four to six months on large operations.

In the case of the Bank of Manhattan Building in New York City, foundations were installed during the demolition of an existing 13 story building. The three months saved in the foundations enabled the builder to complete the building within eleven months of the date of taking over the site. In the case of the Abraham & Straus Department Store, time restrictions were even more severe. Except at a heavy financial loss to the owner, the store could be abandoned only from January to October. The problem was solved by installing the piers one at a time working in partitioned off portions of the selling basement. The excavation of the forty foot cellar was carried on simultaneously with the erection of the new store.

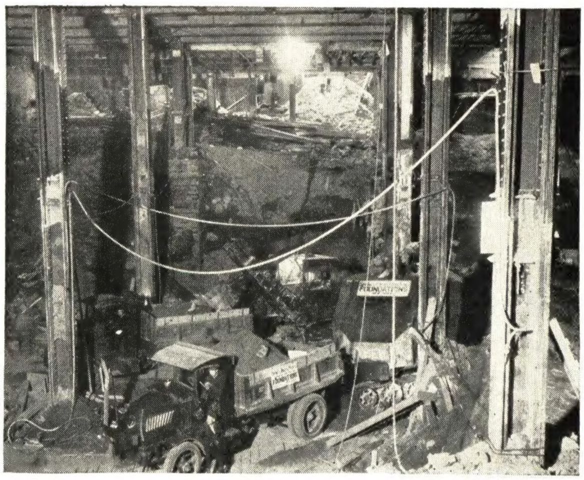
In many cases TUBA Steel Cylinders, caissons, PRETEST Cylinders, or spread footings can be installed in the basements of the old buildings on the site. When necessary, due to lack of space or time, temporary footings sufficient in area to support only a part of the ultimate load are installed, and are increased in size later. Steel erection is started immediately upon completion of the demolition. After the steelwork is under way, the general excavation and incidental work are done, and the temporary foundations increased to their permanent size.

Buildings where these methods were used include:

American Surety Co.,
New York City
Bank of Manhattan Building,
New York City
Wanamaker Store
New York City
A. & S. Department Store
Brooklyn, New York
The J. L. Hudson Co.
Detroit, Michigan

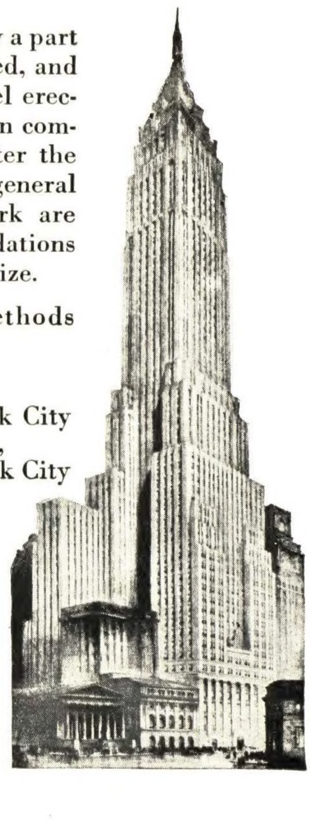


Column of 70 story Bank of Manhattan Building, N. Y. C. supported on 4 foot cylinder installed during demolition. Final pier under construction simultaneously with steel erection.



Excavating for basement after erection of steel. A. & S. Department Store, Brooklyn, N. Y.

Excavation of cellar by means of electric shovels as steel is erected. Hudson Department Store, Detroit, Michigan

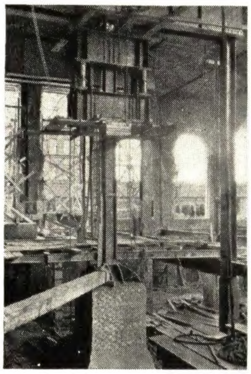


Caisson Foundations installed during demolition of old building, Bank of Manhattan Building, N. Y. C.

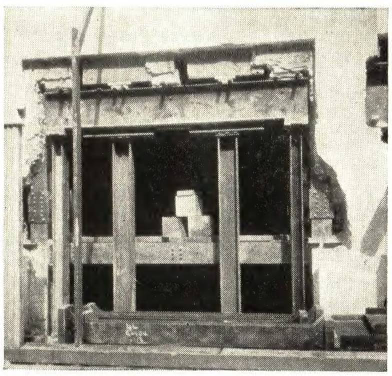
THE PRETEST METHOD APPLIED TO CONSTRUCTION OTHER THAN FOUNDATIONS. The scientific principles underlying the PRETEST METHOD have been applied to features of construction other than foundations.

Structural steel members such as beams, girders, or columns, are often installed within an existing building in order to relieve other structural members of their loading, or to permit of their removal; beams and girders will deflect upon the transfer to them of such loading, and columns will be subject to shortening because of their elastic deformation under compression. Such deflection or shortening may result in serious cracking of the superstructure, unless the transfer of the loading is made while the new members are in a pre-stressed state. This is accomplished by the PRETEST METHOD.

In the Onondaga Savings Bank, in Syracuse, N. Y., the construction of a banking room on the first floor necessitated the removal of the lower portions of several interior columns of the existing nine story building. It was planned to carry these columns above the second floor on girders spanning between adjacent columns on either side. The engineers figured that the transfer of these column loadings to the girders in an unstressed state would cause a deflection of 3/4″. All areas supported by these columns would settle accordingly, floors and walls would crack, and mechanical equipment would be seriously damaged. It was necessary therefore that each girder be deflected 3/4″ before the transfer of the load. Brackets were attached to the column, and by jacking between the girder and these brackets, the proper deflection was applied and held by the PRETEST METHOD until the connection between the column and the girder was completed.



Deflecting girders by the Pretest Method at Onondaga Savings Bank, Syracuse, N. Y. The lower brackets are attached to the girders, the upper brackets to the column, with the hydraulic equipment between.



Installation of store fronts by original shoring method, at 400 Park Avenue N. Y. C. The two center columns shown are temporary.

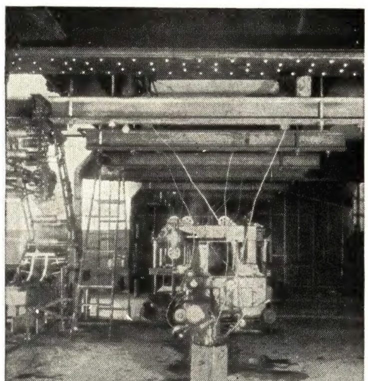
The alteration of the twelve story apartment at 400 Park Ave., New York City, to provide ground floor stores, required the development of an original method of shoring. Two conditions seriously complicated this problem; the building walls are self-supporting, 24″ thick at the first floor, faced with limestone, and carry a load of twelve tons per linear foot at street level; secondly, the New York Central Railroad cut under Park Ave. is only two feet from the face of the building in which the store fronts were to be placed, and no loading from shores could be placed upon the roof over it. All supports and shores had to be confined within the limits of the wall itself. The special method of performing this work as devised by the engineers of Spencer, White & Prentis proved successful, and the new steel frame work installed and PRETESTED without a crack developing in the structure.

The printing plant of the News Syndicate, in Brooklyn, N. Y., is an extremely heavy structure of reinforced concrete. The flat slab of the second floor is 24″ thick, and serves to support printing presses. The presses originally installed were removed after being in operation several years, and replaced by more modern and much heavier units. The floor slab was deemed incapable of supporting the new loadings, and it was decided to support the new presses on a system of structural steel beams and girders immediately beneath the second floor slab, the slab itself serving merely as a medium to transmit the loads of the presses to the new steel system below. The normal deflection of the steel would have damaged the delicate machinery so that prestressing of the steel was necessary. This transfer of loading was successfully accomplished by PRETESTING the beams and girders as the new presses were erected; the actual stresses in these members were verified by strain gauge readings.

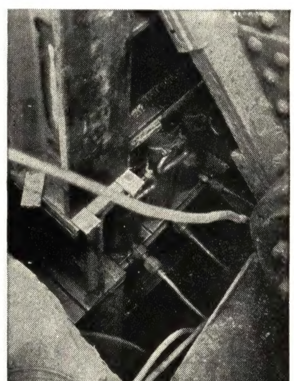
An investigation of the conditions of the Stratford Avenue Bridge, in Bridgeport, Conn., disclosed the fact that deterioration of certain of the truss members was such as to warrant the immediate closing of the structure to traffic. The end posts, particularly, had to be reinforced by adding to them additional structural members. The existing members being under compression, it was necessary to produce in the sections to be added an equivalent compressive stress before the connection was made. This was done by the use of hydraulic equipment, and the new sections PRETESTED before the welding of same to the orginal members.

PRETEST REINFORCEMENT OF RETAINING WALLS. Where lateral support is required as well as additional carrying capacity, inclined PRETEST CYLINDERS are installed. The illustration on the back cover is of a retaining wall at Douglaston, Long Island, so supported. The wall moved laterally, bulged approximately one foot, and cracked. The condition of the wall precluded any work beneath same, and as lateral stability was of greater moment than vertical support, the PRETEST CYLINDERS were placed as shown. The concrete grillage shown reinforced the wall, and served to carry same between the points of support.

The successful solution of unusual and difficult problems is assured by our extensive experience in this class of work, the application of scientific principles, and the personal attention given by the members of this corporation to every job, large or small.

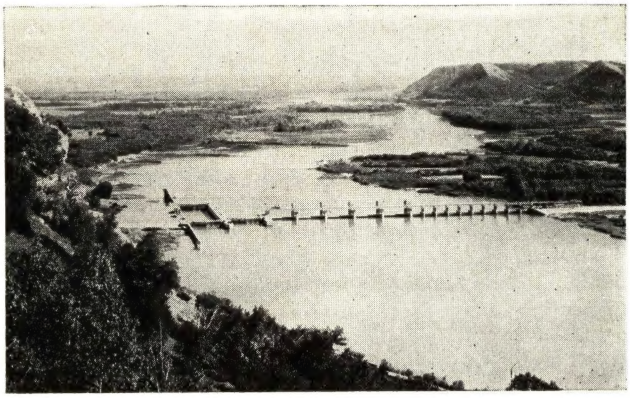


Pretesting steel beams and girders, News Syndicate Building, Brooklyn, N. Y. C.



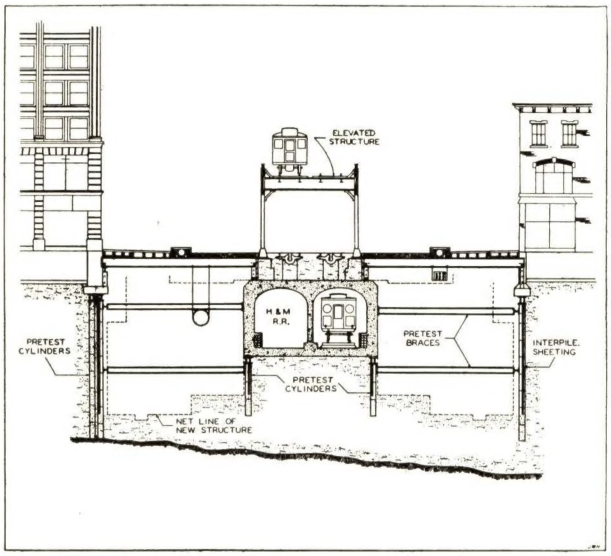
Stressing column reinforcing sections before welding same to original member, Stratford Ave. Bridge, Bridgeport, Conn.

MASS CONCRETE CONSTRUCTION



Lock and Dam No. 6 over Mississippi at Trempealeau, Wis.

SPENCER, WHITE & PRENTIS, INC., are organized and equipped to install heavy concrete structures such as bridge piers, locks and dams, viaducts, retaining walls, etc. Recent installations on the Mississippi River include Lock and Dam No. 6, at Trempealeau, Wisconsin, and Lock No. 3 at Red Wing, Minnesota, for the Corps of Engineers, U. S. Army.



This corporation is at present constructing a section of the new Sixth Avenue subway from 8th to 18th Streets, New York City, a work of outstanding difficulty. A few other S, W & P jobs are listed below.

Wall & Hanover Building, New York City, N. Y.
Starrett Lehigh Building, New York City, N. Y.
19 Rector St., New York City, N. Y.
12 Sub-stations—N. Y. Edison Co., New York City, N. Y.
N. Y. Steam Corp., New York City, N. Y.
F&M Schaefer Brewing Co., Brooklyn, N. Y.
Dime Savings Bank, Brooklyn, N. Y.
E. R. Squibb & Sons, Brooklyn, N. Y.
Gordon Baking Co., Long Island City, N. Y.
Yonkers Telephone Co., Yonkers, N. Y.
Universal Atlas Cement Co., Hudson, N. Y.
Ricketts Laboratory, R.P.I., Troy, N. Y.
Brockport Central High School, Brockport, N. Y.
Stamford Gas & Electric Co., Stamford, Conn.
D. M. Read Department Store, Bridgeport, Conn.
National Newark & Essex Building, Newark, N. J.
Salaam Temple, Newark, N. J.
Industrial Trust Co., Providence, R. I.
First National Bank Bldg., Tampa, Florida
Peninsular Telephone Bldg., Tampa, Florida

SERVICES. Spencer, White & Prentis, Inc., are prepared to consult with architects, engineers and owners on their foundation and underpinning problems, to submit designs, and to install foundations, underpinning, and mass concrete construction.

NEW YORK CITY BUILDING CODE

Adopted July 20, 1937

8. 3. 2. 6 CONCRETE FILLED STEEL PILES

8. 3. 2. 6. 1 General Requirements for Concrete Filled Steel Piles. Piles consisting of concrete filled steel tubes shall have a minimum inside diameter of 10 inches and a shell thickness of at least $\frac{3}{8}$ of an inch (except that 10 and 12 inch piles may have a shell thickness of $\frac{5}{16}$ of an inch). The concrete filling shall be at least equal to average concrete as specified in *7.4.3.3, Average Concrete: Proportions and Allowable Working Stresses.* The ends of each tube shall be perpendicular to its axis, and all bearing surfaces shall be smooth and true-cut by an approved method. Splices shall be of such material and design as to insure good alignment of tubes. If splices below the upper splice are closer together than 20 feet a 5 per cent reduction in load values shall be made for each additional splice used.

Where the borings indicate that piles will be less than 60 feet in length, the minimum designed outside diameter of the tube shall be at least 1/40 of the length. If as actually driven, such piles exceed 40 diameters in length a one per cent reduction in load shall be made for each diameter of excess length. Where borings indicate that the piles will be 60 feet or more in length, the minimum diameter shall be 18 inches and the minimum shell thickness shall be $\frac{1}{2}$ inch, and no reduction from the allowable loading need be made for slenderness ratio.

After driving, the inside of the tube shall be cleaned of any foreign matter before placing the concrete filling. When tubes exceed 50 diameters in length the concrete in the tube below the upper 50 diameters shall be deposited with a tremie or fully lowered bottom-dump bucket. The concrete filling shall never be placed through water (except on specific written approval of the Superintendent after submission of the detailed method of procedure).

8. 3. 2. 6. 2 Concrete Filled Steel Piles Driven to Rock. When driven open-ended to refusal on bed rock the following maximum loads per pile may be used.

10-inch inside diam. pipe	55 tons	16-inch outside diam. pipe	100 tons
12-inch inside diam. pipe	70 tons	18-inch outside diam. pipe	120 tons
14-inch outside diam. pipe	80 tons	20-inch outside diam. pipe	140 tons
15-inch outside diam. pipe	90 tons	22-inch outside diam. pipe	150 tons

These unit values are based on the use of a shell $\frac{3}{8}$ of an inch thick. For each increase of $\frac{1}{16}$ inch in shell thickness an increased capacity of 10 per cent of the base value may be used, with a maximum increase from the above table of 20 per cent when piles are less than 60 feet in length and 10 per cent when 60 feet or over. A reduction of 10 per cent from the base value shall be made when $\frac{5}{16}$ inch shells are used. Piles 20 inches and more in diameter shall be filled with Class "B" concrete according to *7.4.3.3, Average Concrete: Proportions and Allowable Working Stresses.*

Concrete filled steel piles more than 22 inches in diameter shall be considered as reinforced concrete piers (except that the presumptive bearing capacity of the bed rock shall be limited to 60 tons per square foot gross area of tube).

The center to center spacing of tubes when driven to bed rock shall be at least 2 feet, and at least the diameter of the tube plus 10 inches.

8. 3. 2. 6. 3 Concrete Filled Steel Piles Driven to Hard Pan. When driven open-ended to refusal in cemented hard pan continuous to bed rock the following maximum unit loads may be used: 70 per cent of the base value allowed in *8.3.2.6.2, Concrete Filled Steel Piles Driven to Rock;* with a maximum for any pile of 70 tons. Piles so used shall be spaced at least 30 inches from center to center.

8. 3. 2. 6. 4 Concrete Filled Steel Piles Driven to Boulders or a Mixture of Gravel and Boulders. When driven open-ended to refusal in boulders or a mixture of gravel and boulders with no softer material underlying, the following maximum unit loads may be used: 50 per cent. of the base value allowed in *8.3.2.6.2, Concrete Filled Steel Piles Driven to Rock,* with a maximum for any pile of 50 tons. Piles so used shall be spaced at least 20 inches plus the diameter of the tube.

8. 3. 2. 6. 5 Driving Concrete Filled Steel Piles to Refusal. Refusal in connection with the driving of concrete filled steel piles shall mean inability to drive a pile further under a hammer of approved adequate weight after the tube has been completely washed and blown out at the bottom, and before filling with concrete.

8. 3. 2. 6. 6 Concrete Filled Steel Piles Driven Open-ended to Other Materials, or Driven with Closed Ends. When the bottoms of the piles are in or above any material of less sustaining power than prescribed in *8.3.2.6.2, Concrete Filled Steel Piles Driven to Rock, 8.3.2.6.3, Concrete Filled Steel Piles Driven to Hard Pan, and 8.3.2.6.4, Concrete Filed Steel Piles Driven to Boulders or a Mixture of Gravel and Boulders* or when driven with closed ends, they shall be treated as piles cast-in-place as required by *8.3.2.5, Piles Cast-in Place* (except that the minimum shell thickness shall be $\frac{5}{16}$ of an inch and the minimum outside diameter $10\frac{3}{4}$ inches). Tubes may be driven with closed ends, or if started open-ended shall be filled with concrete, the concrete properly cured, and thereafter be driven sufficiently to demonstrate the bearing capacity in accordance with the general requirements for concrete piles. The minimum spacing shall be 2½ feet on centers.

ALLOWABLE LOAD IN TONS, AND SPACING

Diam.	Wall Thick-ness	On Rock			On Hard Pan			On Boulders or Gravel and Boulders		
		Less than 60'	More than 60'	Spac-ing C. to C.	Less than 60'	More than 60'	Spac-ing C. to C.	Less than 60'	More than 60'	Spac-ing C. to C.
10¾"	5/16"	49.5	. . .	24"	34.7	. . .	30"	30.0	. . .	30"
	3/8	55.0	. . .	24	38.5	. . .	30	30.0	. . .	30
	7/16	60.5	. . .	24	42.4	. . .	30	30.3	. . .	30
	1/2	66.0	. . .	24	46.2	. . .	30	33.0	. . .	30
12¾	5/16	63.0	. . .	24	44.1	. . .	30	31.5	. . .	32
	3/8	70.0	. . .	24	49.0	. . .	30	35.0	. . .	32
	7/16	77.0	. . .	24	53.9	. . .	30	38.5	. . .	32
	1/2	84.0	. . .	24	58.8	. . .	30	42.0	. . .	32
14	3/8	80.0	. . .	24	56.0	. . .	30	40.0	. . .	34
	7/16	88.0	. . .	24	61.6	. . .	30	44.0	. . .	34
	1/2	96.0	. . .	24	67.2	. . .	30	48.0	. . .	34
15	3/8	90.0	. . .	25	63.0	. . .	30	45.0	. . .	35
	7/16	99.0	. . .	25	69.3	. . .	30	49.5	. . .	35
	1/2	108.0	. . .	25	70.0	. . .	30	50.0	. . .	35
16	3/8	100.0	. . .	26	70.0	. . .	30	50.0	. . .	36
	7/16	110.0	. . .	26	70.0	. . .	30	50.0	. . .	36
	1/2	120.0	. . .	26	70.0	. . .	30	50.0	. . .	36
18	3/8	120.0	. . .	28	70.0	. . .	30	50.0	. . .	38
	7/16	132.0	. . .	28	70.0	. . .	30	50.0	. . .	38
	1/2	144.0	132.0	28	70.0	70.0	30	50.0	50.0	38
	5/8	144.0	132.0	28	70.0	70.0	30	50.0	50.0	38
20	3/8	140.0	. . .	30	70.0	. . .	30	50.0	. . .	40
	7/16	154.0	. . .	30	70.0	. . .	30	50.0	. . .	40
	1/2	168.0	154.0	30	70.0	70.0	30	50.0	50.0	40
	5/8	168.0	154.0	30	70.0	70.0	30	50.0	50.0	40

GROUP PILE SPACING

Center to Center of Piles "D"	3-Pile Piers		5-Pile Piers	7- or 8-Pile Piers
	a	b	a	a
Inches	Inches	Inches	Inches	Inches
24	14	7	17	21
25	15	7½	18	22
26	15	7½	18½	22½
28	16	8	20	24½
30	17	8½	21½	26
32	19	9½	22½	28
34	20	10	24	29½
35	20	10	25	30½
36	21	10½	25½	31
38	22	11	27	33
40	23	11½	28½	35
42	24	12	30	36½
44	25½	13	31½	38½

SPACING FOR CONCRETE FILLED STEEL PILES